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## PROVISIONAL INTELLIGENCE REPORT

# THE ENGINEERING INDUSTRIES OF SHANG-HAI



CIA/RR PR-72  
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PROVISIONAL INTELLIGENCE REPORT

THE ENGINEERING INDUSTRIES OF SHANG-HAI

CIA/RR PR-72

(ORR Project 38.250)

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FOREWORD

The purpose of this report is to evaluate the engineering industries of Shang-hai, their existing capacity, and their potential for future expansion.

The report is focused on the machinery, electrical equipment and supplies, and shipbuilding and repair industries. The armaments, rail transportation equipment, and aircraft industries, normally included under "engineering", are not covered in this report because of their minor importance in Shang-hai.

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THE ENGINEERING INDUSTRIES OF SHANG-HAI\*

Summary

The engineering industries of Shang-hai in 1954 comprise about 70 major producers and about 2,200 small repair or parts shops. Although the growth in number of plants represents a doubling of the 1948 total of about 1,000 plants, no important increase in the number of larger plants is noted.

About one-third (90,000) of the persons engaged in the engineering industries (excluding armaments) of Communist China are employed in Shang-hai. The employment of such a sizable fraction of the engineering industries' labor force makes Shang-hai a major center for engineering industries in China. The significance of these industries to the economy of Shang-hai, however, is overshadowed by the textile industry of the city, which employs about 60 percent (238,000) of the labor force engaged in manufacturing in Shang-hai.

The engineering industries of Shang-hai registered impressive gains under Chinese Communist administration. Value-added by the engineering industry sector was almost doubled and the output of electrical equipment was more than doubled.

The present Chinese Communist five-year program of industrial development probably will not allocate an important share of investment to the engineering industries of Shang-hai. Further considerable expansion (over 1948 output levels) during this period is expected, however, because the engineering industries of Shang-hai are able to support industrial expansion elsewhere in Communist China.

The expanded production, achieved primarily by applying additional equipment and labor to existing plants, has enabled Shang-hai

\* The estimates and conclusions contained in this report represent the best judgment of the responsible analyst as of 1 July 1954.

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to provide a substantial contribution to the present program of national industrial expansion.

The nature of the modest plant expansion program taking place in Shang-hai during the past four years does not indicate Chinese Communist intentions to attempt a major expansion of the engineering industries in Shang-hai during the present Five Year Plan. Rather, this program appears to be designed to improve Shang-hai's immediate capability to support major industrial expansion elsewhere in the country.

The long-range development of the engineering industries in Shang-hai will be influenced by the development of the large Ta-yeh iron and steel project scheduled for completion in 1957 or 1959. The effect of this project will be to locate convenient to Shang-hai (within 500 miles by river) a major Chinese steel-producing center which will facilitate possible major expansion of the engineering industries in Shang-hai during the course of future five year plans.

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I. Introduction.

A. Industrial Structure.

Shang-hai, with a population of about 6 million persons (1953), is the largest city in Communist China and one of the largest cities in the world. 1/\* It is the largest manufacturing center in China, and prior to World War II, was one of the leading trading ports of the world.

The textile industry is the most important industry of Shang-hai. It is of world-wide importance and is at present the largest center of textile production within the Soviet Bloc. 2/ In 1948 the industry employed 238,000 workers or about 60 percent of the labor force engaged in manufacturing in Shang-hai. Although several other industries located in Shang-hai are of substantial national importance, Shang-hai remains essentially a one-industry city. Table 1\*\* shows the relative importance (as measured by labor employment) of the three principal classes of industry in Shang-hai in 1948, shortly before Communist occupation of the city.\*\*\*

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\* References in arabic numerals are to sources listed in Appendix E.

\*\* Table 1 follows on p. 3.

\*\*\* For a listing of important military and political events affecting the economy of Shang-hai, see Appendix B.

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Table 1

Labor Employment in Manufacturing by Major Industry,  
Shang-hai, 1948 3/

<u>Industry</u>	<u>Number of Workers <u>a/</u></u>
Textiles	238,000
Food, Beverages, and Tobacco	43,000
Engineering	50,500
Others	56,000
Total	<u>387,500</u>

a. Includes technical and administrative employees.

B. Facilities.

Shang-hai has well-developed facilities for the production of thermal electric power, manufactured gas, and water capable of supporting a high level of industrial production. Water transport facilities are excellent, and land transport facilities are adequate for present needs. Two single-track railroad lines connect Shang-hai with Nan-ch'ing to the north and Chang-sha and Kuang-chou (Canton) to the south. 4/ Warehousing facilities were extensive in 1948 and subsequently have undergone further expansion under Communist administration. 5/

C. Development of Trade.

Because of its excellent harbor,\* Shang-hai at the beginning of the 19th century was the principal port and commercial center of the densely populated and highly productive Ch'ang Chiang (Yangtze) delta area. (See Fig. 1, following p. 4.) 6/ Following the opening of the port to foreign trade, in 1842,\*\* Shang-hai's foreign and domestic trade expanded continuously through the 1930's. Shang-hai functioned as a

\* Compared with alternative sites in the Ch'ang Chiang delta.

\*\* The Treaty of Nan-ch'ing (in 1842) at the close of the Anglo-Chinese War of 1840-1842 permitted British citizens to reside in and to engage in trade in certain seaports (called "treaty" ports) including Shang-hai. 7/

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transshipment point for local raw silk, tea, raw materials, and for foreign manufactures flowing inland in the Ch'ang basin. Shang-hai became the leading commercial and trading center of China. 8/

D. Development of Manufacturing.

Manufacturing, primarily of cotton textiles, developed rapidly in Shang-hai following the Shimonoseki Treaty in 1895.\* This development, taking place, for the most part, in the "treaty ports", was speeded by the growing Chinese demand for Western-type manufactures and by the substantial demand for textile and food products which could be manufactured from raw materials abundant in China. 10/

Foreign (and later Chinese) entrepreneurs recognized the gains to be obtained from supplying these markets by applying Western techniques to the cheap and abundant Chinese labor and raw materials. 11/

The selection of Shang-hai as the major manufacturing center was the result of its location near the mouth of the Ch'ang Chiang, which provided cheap access to inland consuming and producing areas and which at the same time was readily accessible to ocean shipping. 12/

II. The Engineering Industries.

A. Development.

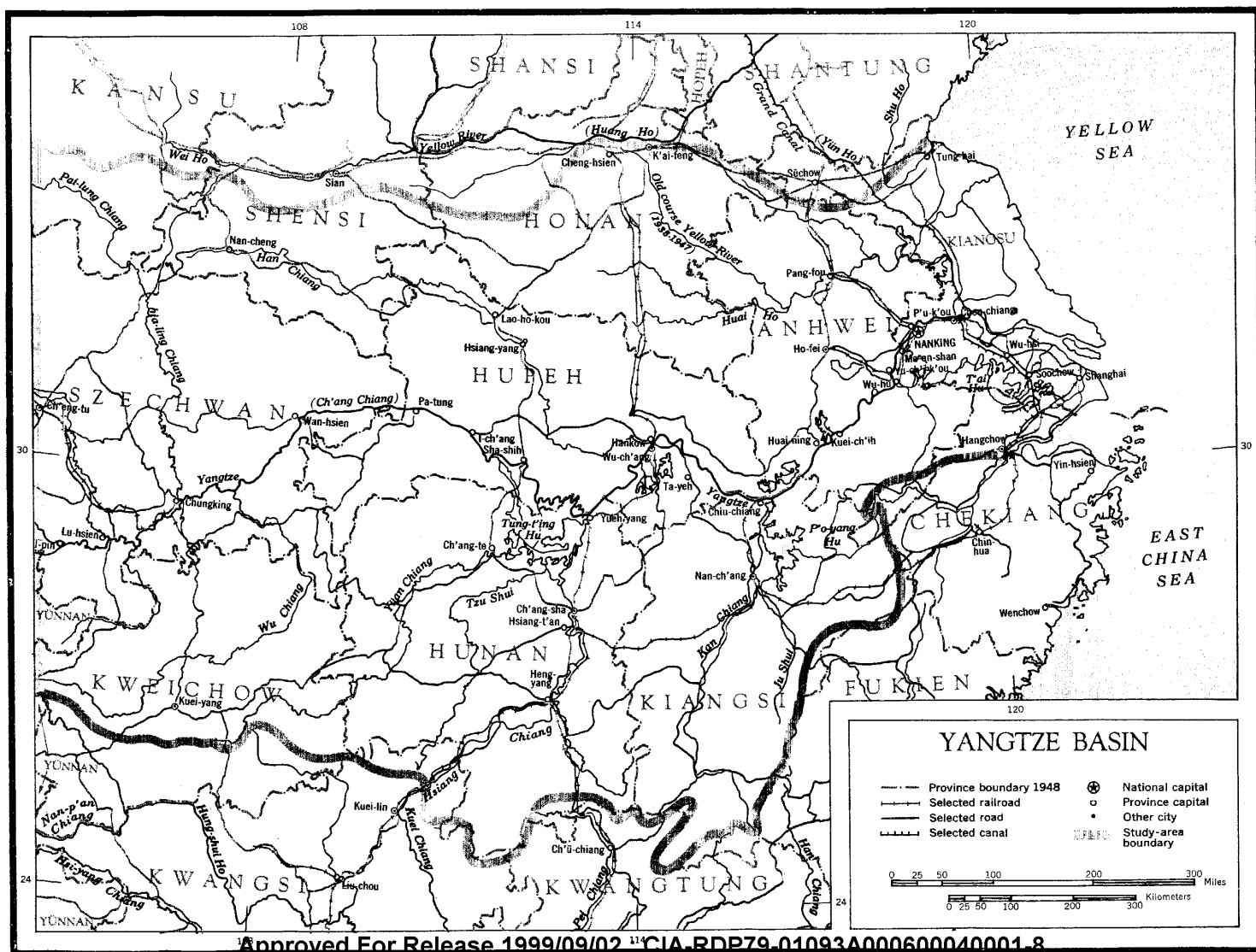
Development of the engineering industries in Shang-hai paralleled and supported the growth of other sectors of the local economy.

Early engineering industry establishments were designed for the repair and maintenance of imported machinery. Except for the primarily foreign-owned or-operated shipbuilding industry, manufacturing facilities were rudimentary and technology limited. To service ocean-going vessels some of the early shipyards were of substantial size. 13/

To take advantage of low Chinese labor costs, foreign and Chinese entrepreneurs gradually undertook to supply the local market

\* The Treaty of Shimonoseki in 1895, following China's defeat in the Sino-Japanese War, gave formal permission for Japanese subjects (and consequently those of all "treaty" countries) to engage in manufacturing enterprises in "treaty" ports, including Shang-hai. 9/

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by assembling small quantities of Western-type engineering products in Shang-hai. 14/

Small but increasing numbers of modern steam-operated vessels equipped with imported propulsion units were constructed. Just preceding and during the 1920's a small number of medium-sized, modern plants were constructed by foreign firms for the partial manufacture and assembly of a limited variety of electrical products. The new plants produced small household electrical appliances, lamps, batteries, telephone and telegraph supplies, fractional-horsepower and other small motors and transformers. 15/

Throughout the period there was a steady improvement in technology as evidenced by the range and complexity of the engineering products produced. Although these improvements were initiated by foreign engineers, the new technical skills were acquired by the Chinese employees who in turn established plants. 16/

The major expansion of the engineering industries took place during the periods 1935 to 1936 and 1939 to 1940. (See Chart 1 following p. 6.) These two "boom periods" reflected the major expansion of facilities and improvements in technology accomplished under early Western and later Japanese influence. During these periods the products of Shang-hai's engineering industries were distributed widely throughout China. 17/

Recovery after World War II was rapid although spotty. The principal gains took place in the electrical equipment and machinery industries. Because of the small but relatively continuous additions to plant capacity during the period, 1948 capacity probably exceeded that of even the peak year of 1940. Output of the engineering industries in 1948, however, fell just short of 1940 output because of recurring raw materials shortages. 18/

The pre-Communist development in Shang-hai, culminating in 1948, elevated the engineering industries from the status of rude repair shops of limited technology (albeit the largest single collection in China) to fairly modern machinery, electrical equipment, and shipbuilding plants of national importance, with a greatly increased level of technology. Shang-hai's engineering industries remained rudimentary in comparison with Western countries. These plants produced a modest surplus of a limited range of engineering products distributed throughout the country and even exported to Southeast Asia. 19/

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B. Structure.

The technological gains of the earlier decades were actually confined to a small number of engineering industry plants. In 1948 there was a total of 1,000 engineering industry establishments, including about 750 machinery plants, 230 electrical equipment plants, and from 20 to 30 shipyards. 20/ Of these, however, less than 70 were actual producing units of advanced technology.\* By 1954 the number of plants is reported to have been increased to 1,500 machinery plants, 791 electrical equipment plants, and 39 shipyards. 21/ This expansion did not involve, however, an important increase in the number of the larger plants. The remainder continued to be small repair or parts shops.

Despite the small size and limited technology (by Western standards) of even the larger plants, the Shang-hai engineering industries provide a significant and a currently increasing contribution to the present Chinese Communist program of industrial development. In 1953 about one-third of China's total labor force engaged in the production of engineering products (excluding weapons and ammunition) was employed in Shang-hai.\*\*

The machinery industry is the largest of the three principal classes of engineering industry in Shang-hai, employing about 56 percent of the labor force employed in the sector in 1948 as shown in Table 2.\*\*\* The percentage declined to about 47 percent in 1953.

The shipbuilding and electrical equipment industries have experienced the greatest growth since the beginning of Communist domination in Shang-hai. This is accounted for by the higher priorities placed on these industries resulting from the Korean War and from the needs of the present industrial expansion program. A larger proportion of the products of the shipbuilding and electrical

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\* A list of these plants is contained in Appendix A. The location of these plants is shown in Figure 2, following p. 30.

\*\* Total employment in the engineering industries of China in 1952 (excluding weapons and ammunition) is estimated at between 225,000 and 275,000. 22/ After allowing for an increase in 1953 to the top of the range (i.e. to about 270,000), the estimated 90,000 persons employed in Shang-hai in 1953 amounts to one-third of the total.

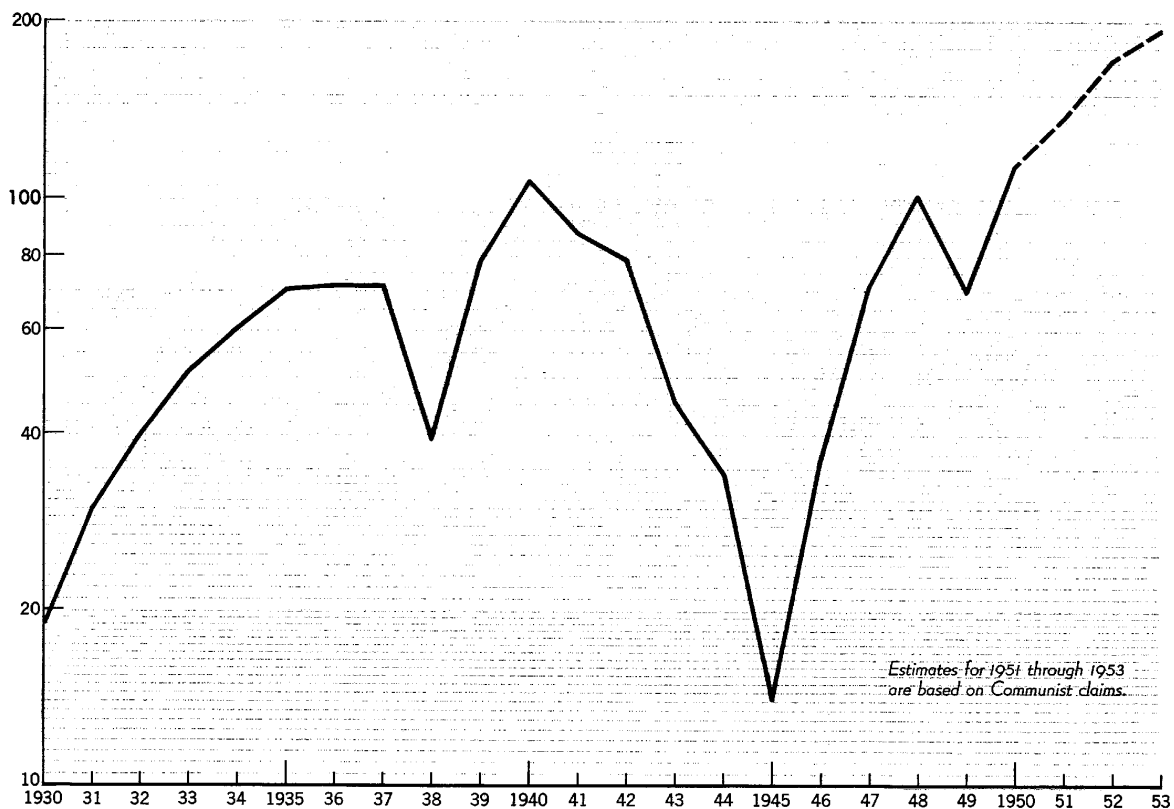
\*\*\* Table 2 follows on p. 7.

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THE ENGINEERING INDUSTRIES: INDEX OF VALUE-ADDED, 1930-53

1948=100



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Table 2

Gross Production, Value-Added, and Employment  
in the Engineering Industries in Shang-hai  
1948 and 1953 a/

Value in Billion Yuan, 1952 Prices						
Industry	<u>Gross Production</u>		<u>Value-Added</u>		<u>Employment</u>	
	<u>1948</u>	<u>1953</u>	<u>1948</u>	<u>1953</u>	<u>1948</u>	<u>1953</u>
Machinery	1,500	2,200	1,000	1,400	28,500	42,500
Electrical Equipment	900	2,100	600	1,400	10,000	23,000
Shipbuilding	1,500	3,400	700	1,600	9,000	20,000
Independent Foundries <u>b/</u>	200	300	100	200	3,000	4,500
Total <u>c/</u>	<u>4,100</u>	<u>8,000</u>	<u>2,400</u>	<u>4,600</u>	<u>50,500</u>	<u>90,000</u>

a. The increased employment and output estimates in 1953 are based on Chinese claims. Sources and methods employed in making the estimates are presented in Appendix C. Because of rounding the ratios of the 1948 to the 1953 gross production and value-added data in this table may not agree with the indexes given in Appendix C.

b. An estimated three-fourths of the output of these foundries consists of machine parts. 23/

c. Aircraft and land and rail transport industries are not estimated because of their small relative importance in Shang-hai.

equipment industries have a direct military value than have the products of the machinery industry.

C. Organization.

Nearly all of the largest engineering industry establishments in Shang-hai in 1954 are under state operation, either directly or as joint state-private operated establishments.\* In 1949, at the time

\* Including the Shang-hai Machinery Factory, the Ch'iu-chiang Machinery Manufacturing Plant, the Shang-hai Diesel Engine Factory, the Shang-hai Electrical Machinery Works, the Shang-hai Wire Factory, and the Chiang-nan Shipyard. (See Appendix A).

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of the "liberation" of Shang-hai, all of the plants owned by the various economic bureaus of the Nationalist Government were taken over by the Shang-hai Military Control Commission. By 1951 these plants had been placed under operation of the East China Department of Industry. 24/

Early in 1952 the Central People's Government took steps to ensure full central control over state-owned enterprises by placing local state-owned plants under the control of the Machine Industry Bureau of the Ministry of Heavy Industry. 25/ In August 1952 the Bureau was elevated to ministerial status as the First Ministry of Machine Building Industry.\* 26/

It is believed that all or most of the state-owned engineering industry plants in Shang-hai, including shipbuilding, electrical equipment, and machinery manufacturing, are controlled directly by the various bureaus of the First Ministry of Machine Building Industry.

The majority of the principal engineering industry plants (listed in Appendix A) and all of the many small plants in Shang-hai remain privately owned. However, because of the virtual monopoly held by the state trading companies over the supply of materials essential to the engineering production and the apparent supplying of materials only for the fulfilling of state contracts, few of the activities of the privately owned plants take place outside the direct control of the Central Government.\*\* 28/

To facilitate the negotiation of contracts between the state trading companies, many of the small and medium-sized engineering industry establishments have been encouraged to form associations. Each of these associations provides the services of centralized contract negotiations and the procurement of raw materials for its member plants. 31/ These associations appear to include establishments in both the machinery and electrical equipment industries.

\* An additional ministry, the Second Ministry of Machine Building Industry, was also formed at this time. This Ministry is believed to control the armaments plants. 27/

\*\* The movement toward state participation in all transactions has steadily increased in Shang-hai. The total value of government contracts expressed as a percentage of the total value of transactions of all private industry in Shang-hai for the years 1950-1953 are as follows: 1950: 32 percent; 1951: 44 percent; 1952: 58 percent 29/; 1953: 63 percent. 30/

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Few joint state-private engineering industry firms have been established in Shang-hai. Most of the joint state-private plants which have been identified were founded shortly after the "liberation" in 1949. However, a new movement toward their formation appears to have been under way in late 1953 and early 1954. In March 1954 the Shang-hai press published a complaint that although the "superiority" of joint public-private operated firms is obvious, the existing ones are too small in number. Ten days later the press announced the formation of 13 new joint state-private firms and the approval of an additional 20 such establishments. Four machinery and electrical equipment firms were included among the newly organized firms. 32/

D. Production.

The engineering industries have registered impressive gains during the first four years under Chinese Communist administration. Based upon Chinese claims, estimated over-all production has almost doubled and the production of individual engineering products, particularly electrical equipment items, has in most instances more than doubled.

These gains have been achieved primarily through the more intensive use of existing facilities and to a lesser extent through the expansion of existing capacity and the construction of new plants. Estimates of the gains in the production of important engineering products are presented in Tables 3, 4, and 5.\*

1. Electrical Equipment.

The most impressive gains of the four year period have been achieved in the production of electrical equipment as shown in Table 3. Estimated increases in the production of selected electrical equipment products are presented in Table 4.

The major proportion of motors (mostly in sizes smaller than 200 kilowatts), transformers, and generators are produced by the Shang-hai Electrical Machinery Works. The large production increase in these items is attributable to the construction of a large new plant "in the outskirts" of Shang-hai.\*\*

\* Tables 3, 4, and 5 follow on pp. 10, 11, and 12, respectively.

\*\* This plant has not been located and does not appear on Figure 2. See Appendix A.

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Table 3

Production of Selected Electrical Products  
in Shang-hai, 1948 and 1953 a/

<u>Item</u>	<u>Unit</u>	<u>1948</u>	<u>1953</u>
Electric Motors	Kilowatts	192,000	442,000
Generators	Kilowatts	35,000	80,500
Transformers	Kilovolt-Amperes	257,000	590,000
Electric Lamps	Thousand Units	72,000	72,000
Storage Batteries	Units	80,000	180,000
Electric Wire and Cable	Metric Tons	600	1,300

a. See Appendix C for sources and methods employed in making these estimates.

The increased production of electric wire and cable is attributable primarily to the major expansion undertaken by the Communist government of the Shang-hai Wire Factory.

Other important electrical products produced in substantial quantities are switch gear by the Hua-t'ung Electric Machinery Manufacturing Company; telephone and telegraph equipment by the China Electric Company; and "various types of radio equipment" by the Ya-chow (Asia) Radio Equipment Plant.

2. Shipbuilding.

Substantial increases in the output of the Shang-hai shipyards have been attained, although there has been no increase in the production of steel ships. In addition to ship construction the shipyards have been engaged to a large extent since 1949 in ship repairs, in making hydraulic equipment for the Huai Ho water conservancy project, and in filling a substantial number of contracts for items such as truck chains, turbo-generator sets (in cooperation with the Shang-hai Electrical Machinery Works), and in the production of diesel engines. 33/

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Table 4

Production of Steel and Wooden Ships in Shang-hai  
1948 and 1953 a/

Gross Register Tons		
Item	1948	1953
Steel Ships	2,260	b/
Wooden Ships	30,000	45,000

a. For sources and methods employed in making the estimates, see Appendix C.

b. Naval boats totaling 900 displacement tons. 34/

In addition to the production listed above, several dredges and at least one floating dry dock have been built at various yards. 35/

3. Machinery.

The machinery industry attained the smallest gains of the three engineering industry sectors in Shang-hai between 1948 and 1953. Table 5 presents estimates of the production of selected products in this category.

The production of machine tools has been assigned high priority. This production is concentrated at the state-owned Ch'iu-chiang and Ming-ch'ing machine tool plants. As early as June 1950, plants producing machine tools received top priority for electric power then in short supply because of the bombing of the Shang-hai Power Company, 6 February 1950. 36/

The principal producers of textile machinery in Shang-hai are the recently expanded state-owned China State Textile Machine Plant and the privately owned Ho-p'ing Machinery Plant. Pumps are made by the state-operated Ta-hsin Machinery Plant and the joint private-state operated Shang-hai Machine Works. Steam and diesel engines are made by the Shang-hai Machinery Factory, the Shang-hai Machine Works, and in small sizes by the Shang-hai Diesel Engine Factory. The Chinese Communist press recently reported that the state-operated Chiu-hsin (Kiou-sin) Shipyard has been producing 150-horsepower marine diesel engines. 37/

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Table 5

Production of Selected Machinery Products in Shang-hai  
1948 and 1953 a/

<u>Item</u>	<u>Unit</u>	<u>1948</u>	<u>1953</u>
Machine Tools	Units	1,200	1,800
Diesel Engines	Horsepower	8,600	12,800
Steam Engines	Horsepower	3,400	5,000
Coal Gas Engines	Horsepower	1,900	2,800
Other Engines	Horsepower	2,000	3,000
Boilers	Units	1,300	1,900
Cotton Spinning Machinery	Spindles	60,000	100,000
Weaving Looms	Units	7,200	10,700
Pumps	Units	900	1,300
Cast Iron Machine Parts <u>b/</u>	Metric Tons	22,500	32,000

a. For sources and methods employed in making the estimates, see Appendix C.

b. Produced in independent foundries, that is, those not directly attached to machinery plants or to steel plants.

In addition to the machinery products listed in Table 5, substantial quantities of other machinery products are produced in Shang-hai. These include mining machinery produced by the Shang-hai Mining Machinery Plant, overhead cranes (up to 100-ton capacities) and water-tube boilers by the P'u-kiang Machinery Plant\* and tungsten carbide-tipped cutting tools produced by the Shang-hai Tool Plant.

E. Input Requirements.1. Materials.

Although the list of products currently being produced by the engineering industries in Shang-hai is impressive, the actual quantitative significance of this output, judged by Western standards, can be gauged by the relatively small amounts of steel and copper re-

\* Formerly the American-owned Anderson Meyer Machinery Company.

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quired for this production. A comparison of the estimated amounts of coal, electric power, steel, and copper required by the engineering industries in 1948 and 1953 is presented in Table 6.

Table 6

Consumption of Selected Materials by the Engineering Industries in Shang-hai  
1948 and 1953 a/

<u>Item</u>	<u>Units</u>	<u>1948</u>	<u>1953</u>
Pig Iron <u>b/</u>	Metric Tons	60,000	115,000
Rolled Steel Products	Metric Tons	44,000	84,000
Copper and Brass	Metric Tons	3,000	6,000
Coal	Metric Tons	16,000	31,000
Electric Power <u>c/</u>	Thousand Kilowatt-Hours	12,600	24,200

a. For sources and methods employed in making the estimate, see Appendix C.

b. Includes the requirements of the independent ferrous metal foundries.

c. Includes power purchased from the Shang-hai Power Company only.

A substantial proportion of both pig iron and rolled steel requirements is believed to have been obtained from the Northeast District throughout most of the period 1949 to 1953. 38/ Although the modest capacity of the Shang-hai iron and steel plants for producing rolled steel products probably is adequate to support local rolled steel requirements, available evidence indicates that these plants have been operating at levels well below capacity at least until 1953. 39/

2. Manpower.

Workers in the technical, administrative, and skilled categories are extremely scarce in Shang-hai primarily because of expansion of output during the past four years. In addition, the recent repatriation of most of the remaining Japanese technicians, the expatria-

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tion of technicians of White Russian origin, and the considerable movement of Chinese technicians from Shang-hai to other parts of China\* have added to the substantial and growing deficit of skilled personnel. There is no evidence that Soviet technicians have been utilized to an appreciable extent to alleviate the shortage. 41/

The substantial expansion of engineering industry employment between 1948 and 1953 (see Table 7)\*\* is believed to have been accomplished only with a severe deterioration of the average level of skill within the upper skill categories. The expansion has been achieved by upgrading individual workers from the lower skill categories.

Recruitment of workers for the unskilled category apparently can be accomplished with comparative ease. Reports indicate that "raw country boys" can be taught most of the routines necessary for working in engineering industry establishments within periods of two weeks. 42/

For these reasons a comparison of the sizes of the skill categories between 1948 and 1953 is meaningless and has not been attempted in Table 7.

3. Plant and Equipment.

a. Plant.

Most of the principal engineering industry plants in Shang-hai are small to medium in size in comparison with Western plants producing similar products. Characteristically they specialize in the simple machining and assembly of final products.\*\*\* Relatively few of these plants are equipped with foundries or forges. Most of the castings and forgings required in the production of machinery are purchased either from the independent foundries or from the iron and steel plants. 43/

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\* Considerable movements have been reported of technical personnel from Shang-hai to the Southwest, Northwest, North, and Northeast Regions. Although the bulk of those transferred were not engineering industry technicians, the movement is believed to have increased the severity of the shortage of technical, administrative, and skilled workers in the engineering industries. 40/

\*\* Table 7 follows on p. 15.

\*\*\* With the exception of the principal shipyards.

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Table 7

Employment in the Engineering Industries  
in Shang-hai  
1948 and 1953 a/

Industry	1948	1953
Machinery (including independent foundries)	31,500	47,000
Electrical Equipment	10,000	23,000
Shipbuilding	9,000	20,000
Total	50,500 <u>b/</u>	90,000

a. For sources and methods employed in making the estimate see Appendix C.

b. Estimated breakdown by level of skill in 1948 is as follows:

Technical, administrative, and clerical	12 percent
Skilled and semi-skilled	62 percent
Unskilled	26 percent

A few of the major plants, including the Shang-hai Machinery Factory, the P'u-kiang Machinery Plant, the Ming-ch'ing Machinery Factory, and the Ch'iu-chiang Machinery Plant have foundries and forges located on the same premises as the machinery and assembly plants.\* Others, such as the China State Textile Machine Plant and the Ho-p'ing Machinery Plant, have large-scale foundries located within a mile or two of the machining and assembly plants.

b. Equipment.

The modest extent of the present level of development of the engineering industries in Shang-hai in comparison with that of

\* This category also includes the principal shipyards: Chiang-nan, Chiu-hsin, Hu-tung, and Ying-lien Shipyards.

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Western countries is further supported by the small machine tool park available in Shang-hai. (See Table 8.)

Table 8

Inventory of Machine Tools  
in the Engineering Industries in Shang-hai  
1948 and 1953 a/

Item	Units	
	1948	1953
Lathes	8,000	11,700
Drills	2,000	2,900
Milling Machines	900	1,300
Others	5,600	8,200
Totals	<u>16,500</u>	<u>24,100</u>

a. For sources and methods employed in making the estimates, see Appendix C.

The increase in the number of machine tools required by the engineering industries probably has been filled in part by the substantial stocks of UNRRA - imported US and UK equipment stored in various warehouses in the vicinity of Shang-hai at the time of the Communist occupation and from imports from other Soviet Bloc countries. 44/ These additional tools, probably of much higher quality than most of those included in the 1948 inventory, have been allocated primarily to state and joint state - private operated plants. 45/ The comparatively few machine tools allocated to privately owned plants probably have come entirely from local current production.

#### 4. Transportation.

The low degree of vertical integration which characterizes most of the principal engineering plants in Shang-hai imposes a heavy burden on local transportation facilities. In addition to the movement of raw materials to the producing plant and the movement of finished products from the manufacturing plant to the final consumers, countless

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parts (including heavy castings) must be shipped from subassembly to final assembly sites.

Most of these movements take place by truck although plants located on the many navigable water-ways in Shang-hai are able to make use of barges. In late 1952 there was no evidence of railroad spurs or sidings located within usable distance of many of the principal plants. <sup>46/</sup> In addition to the heavy burden which it imposes on trucking services, this lack of railroad facilities also severely limits the sizes of heavy equipment which can be regularly produced by these plants.

III. Future of the Engineering Industries.

Shang-hai probably will not receive an important share of investment funds allocated to engineering industry expansion during the course of the present five-year program of industrial development. Shang-hai's present importance probably will suffer a relative decline as engineering industries in other areas are developed.

The major advantages which the engineering industries in Shang-hai have over alternative locations are the substantial number of medium-sized plants in operation and the substantial pool of technical and skilled labor. They are offset, however, by short run disadvantages such as the inadequacy of the local transport system, the present shortage of electric power, and the great distance separating Shang-hai from the major iron and steel producing centers in the Northeast District.

Recent developments appear to support this analysis. Announcements of the ten "key point" engineering industry construction (and reconstruction) projects for the first year of the 1953 to 1957 Five Year Plan do not include projects located in Shang-hai. <sup>47/</sup> Two Shang-hai engineering industry projects included in supplementary plans were among those to be postponed until 1954 when Chia To-fu announced in January 1953 a thirty-percent cut in the 1953 plant construction program.\* <sup>48/</sup>

\* The planned projects were the expansion of the Shang-hai Electrical Machinery Works and the Shang-hai (Tung-yung) Machinery Factory, valued together at 100 billion yuan.

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Further support is given by developments in the iron and steel industry. Steel rolling capacity in Shang-hai probably is sufficient for supporting the present and foreseeable needs of the local engineering industries. <sup>49/</sup> Pig iron production capacity, however, is negligible. <sup>50/</sup> The Ma-an-shan (see Fig. 1)\* project, located on the Ch'ang Chiang 200 miles from Shang-hai and involving the reconstruction of 6 old and relatively inefficient blast furnaces, apparently is designed to reduce this deficit. <sup>51/</sup>

The long-range view of the future of the engineering industries of Shang-hai is not clear. The makeshift nature of the Ma-an-shan project suggests that it is designed to improve temporarily the self-sufficiency of Shang-hai pending the completion of the large-scale steel mill at Ta-yeh. If development of the Ta-yeh iron and steel project is to be as large as the Chinese Communist press presently claims, it will place near Shang-hai a major iron and steel center, which could be used as a base for major engineering industry development in Shang-hai in the future. <sup>52/</sup>

The engineering industries in Shang-hai probably will experience moderate growth during the course of the present Five Year Plan because of the important support which they, as a presently functioning center, can contribute to more important industrial expansion elsewhere in the country.

The gains achieved in output in the last four years are attributable primarily to the more intensive utilization of existing plant, accompanied by modest absolute increases in labor and equipment. The modest investment in new and reconstructed engineering industry plants appears to have been designed to achieve increases in the production of commodities or services most useful in supporting the current construction program. (See Table 9.)\*\*

In March 1954 a modest new engineering industry construction program to require about 4 years for completion was announced for Shang-hai. The program, which includes the reconstruction and expansion of five of the major engineering plants (see Table 10)\*\*\* in Shang-hai, appears to be a continuation of, and possibly an ex-

\* Fig. 1 follows p. 4.

\*\* Table 9 follows on p. 19.

\*\*\* Table 10 follows on p. 21.

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Table 9

Important Expansion Projects in the Engineering Industries  
in Shang-hai  
1949-54

<u>Date Begun</u>	<u>Product Produced</u>	<u>Name</u>	<u>Nature of Project</u>	<u>Date Completed</u>
1949	Cutting Tools	Shang-hai Tool Plant	Reconstruction and expansion of war-des-troyed plant.	1950 <u>53/</u>
1950	Cranes and Boilers	P'u-chiang Machinery Plant	Major expansion of machine shop.	Before October 1952 <u>54/</u>
1950	Textile Machinery	China State Textile Machine Plant	Modernized foundry.	1952 <u>55/</u>
1950	Wire and Cable	Shang-hai Wire Factory	Expanded to four times its original size.	N.A. <u>56/</u>
Probably 1950	Electrical Machinery	Shang-hai Electrical Machinery Works	Major construction.	Probably 1952 <u>57/</u>
N.A.	Electrical Precision Instruments	N.A.	New construction.	1954 <u>58/</u>
In Progress October 1952	Ship Repair	N.A.	New construction of graving dock (100 ft x 20 ft).	N.A. <u>59/</u>

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Table 9

Important Expansion Projects in the Engineering Industries  
in Shang-hai  
1949-54  
(Continued)

<u>Date Begun</u>	<u>Product Produced</u>	<u>Name</u>	<u>Nature of Project</u>	<u>Date Completed</u>
In Progress October 1952	Ship Repair	N.A.	New construction of graving dock (500 ft x 50 ft).	N.A. <u>60</u> /
In Progress October 1952	Ship-building	N.A.	New construction of three 150-foot building-ways and seven 100-foot ways.	N.A. <u>61</u> /
In Progress October 1952	Ship-building	N.A.	New construction of two building-ways, 160 feet and 100 feet.	N.A. <u>62</u> /

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pansion of, the program of modest expansion which has been in progress since mid-1949.

Table 10

Reconstruction a/ Projects in the Engineering Industries  
in Shang-hai Planned for 1954 63/

<u>Product Produced</u>	<u>Plant Name b/</u>
Electrical Machinery	Shang-hai Electrical Machinery Works
Turbines	Shang-hai Steam Turbine Works (Unidentified)
Boilers and Cranes	Shang-hai Boiler Factory (Possibly the P'u-chiang Machinery Factory)
Machine Tools	Ch'iu-chiang Machine Building Factory
Cutting Tools	Shang-hai Tool Factory

a. Plant reconstruction projects are defined by the Chinese government as projects which expand or reconstruct the original foundations of a plant.

b. The source gives only the names of the products which the five plants to be reconstructed are producing at present. The plant names listed are those of the present principal producers of the listed products. These probably are the plants to be expanded.

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APPENDIX A

PRINCIPAL PLANTS IN THE ENGINEERING INDUSTRIES

1. Important Machinery Plants by Principal Product.\*

a. Textile Machinery.

Ch'eng-fu Iron Works. 64/ (1m\*\*) (Privately owned.)  
Contained 59 machine tools in 1948; no foundry.

China State Textile Machine Plant. 65/ (3m, 4m, 5m)  
(Probably owned by the First Ministry of Machine Building Industry.) Foundry remodeled from September 1950 to September 1952. Much of the machinery used was imported by UNRRA. Two thousand workers employed in plant in 1952. Former site of the Japanese-owned Toyoda Automobile Plant.

Ho-feng Iron Works. 66/ (6m) (Privately owned.) Contained 38 machine tools in 1948. Has foundry and power plant.

Ho-p'ing (or P'ing-ho) Machinery Plant. 67/ (7m, 8m)  
(Privately owned.) Total of 171 machine tools in 1948. British owned in 1948.

Hsin-i (Sing Yih) Machinery Plant. 68/ (9m) (Privately owned.) Has no foundry; 110 machine tools in 1948.

Li-sheng Textile Machine Factory. 69/ (10m) (Privately owned.) Had foundry and 82 machine tools in 1948.

\* Photo interpretation reports and other material on each of the plants listed in Appendix A are available in the files of ORR.

\*\* The number and letter designation refers to the map location of the plant. (See Fig. 2 following p. 30). In instances where a particular plant has several buildings in various areas of Shang-hai more than one map reference is given. The street addresses for the plants listed in Appendix A are also given on the map mentioned above.

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Shang-hai Central Machinery Manufacturing Plant. 70/ (11m)  
(Formerly the Chung-yang Machine Shop, 1941, and the Y. C. Brothers Engineering Works, 1949.) Contained 93 machine tools in 1948.

Su-chung (Sino-Soviet) Machine Manufacturing Company, Ltd. 71/ (12m) (Privately owned.) (Also called the China Rehabilitation Machine Works, Ltd.) Contained 84 machine tools in 1948.

Ta-ch'ang-yuan Iron Factory. 72/ (13m) (Privately owned.)  
May have foundry.

Yuan-feng Machinery Plant. 73/ (14m) (Privately owned.)  
Contained 61 machine tools in 1948. Probably has foundry.

b. Machine Tools.

Ching-mei Machinery Plant. 74/ (15m) (Probably owned by the First Ministry of Machine Building Industry.) Has foundry. Produces light machine tools.

Ch'iu-chiang Machine Building Factory. 75/ (16m) (Probably owned by the First Ministry of Machine Building Industry, formerly the Shang-hai plant of National Agricultural Engineering Company.) Has foundry. Produces universal and tool grinders and horizontal boring machines. Employed over 1,000 workers in 1949.

Heng-hsin Company, Ltd. (Hun Sin Trading Company). 76/ (17m) (Privately owned.) Probably has foundry. Produces heavy machine tools.

Hsin-min (Sin Min) Machine Works. 77/ (18m, 19m) (Privately owned.) Probably has foundry. Produced machine tools, mining equipment, boilers, and railway equipment.

Ming-ch'ing (or Min-ch'ing) Machinery Plant. 78/ (20m)  
(Probably owned by the First Ministry of Machine Building Industry.) Probably has foundry. Produces planers, turret and engine lathes, crank shapers, and gear hobbors.

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Shang-hai Tool Plant. 79/ (21m) (Probably owned by the First Ministry of Machine Building Industry, formerly the Hsieh-hsing Iron Works.) Plant reconstructed and expanded beginning in June, 1949. Plant produces tungsten-carbide cutting tools, gear hobs, highspeed drills, milling cutters, circular saws, taps, and reamers. No evidence of a foundry.

T'ai-li (or Ta-lung) Machine Works. 80/ (22m) (Privately owned.) Has foundry. Produces lathes and other machine tools. Employed about 900 workers in 1941.

Ta-t'ung Iron Works. 81/ (23m) (Joint public-private owned.) May not have own foundry. Produces lathes, shapers, and milling machines.

c. General Industrial Machinery.

Ch'en-tan (Aurora) Machinery and Iron Works. 82/ (24m) (Privately owned.) May not have foundry. Produces pumps, fire extinguishers, and water meters.

Shang-hai Chin-kang Steel Boiler Works. 83/ (25m) (Privately operated.) Produces small furnaces and boilers.

P'u-chiang Machinery Plant. 84/ (26m) (Probably owned by the First Ministry of Machine Building Industry, formerly the Anderson Meyer Machine Tool Plant.) Has foundry. Produces large cranes and boilers. Facilities expanded between 1950 and 1952. Employed up to 1,500 workers prior to World War II.

Shang-hai Machinery Factory.\* 85/ (Probably owned by the First Ministry of Machine Building Industry, formerly the T'ung-yung (General) Machine Building Factory.) Produces high pressure centrifugal pumps (30 to 200 horsepower), blowers (2 to 70 horsepower), fans (1 to 200 horsepower, air compressors (2 to 75 horsepower), overhead traveling cranes (up to 25 tons), hoists (75 horsepower), diesel engines (up to 375 horsepower), pneumatic hammers ( $\frac{1}{4}$ -ton).

Ta-hsin (or Dahsin, Datsin, etc) Machinery Plant. 86/ (27m) (Owned by the First Ministry of Machine Building Industry,

\* Not located on map.

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3rd Bureau.) Plant is primarily a foundry, produces winches, pumps, sand mixers, ore crushers, hoists, and cast steel machinery parts.

d. Engines and Turbines.

New China Power Machinery Factory. 87/ (28m) (Joint private-state owned; probably operated by the First Ministry of Machine Building Industry, formerly the Hsin-chung Engineering Company.) Contained 49 machine tools in 1948. Employed 400 workers in 1952 when plant was expanded. Produces coal gas and diesel engines, pumps, air compressors, ore crushing machinery.

Shang-hai Machine Works, Ltd. 88/ (29m) (Joint public-private operated. Probably under the First Ministry of Machine Building Industry.) Contained 74 machine tools in 1948. Probably has no foundry. Produces diesel engines and pumps.

Shang-hai Diesel Engine Factory.\* 89/ (Probably owned by the First Ministry of Machine Building Industry, formerly the Wu-sung Machinery Plant, prior to 1949 the Wu-sung plant of the National Agricultural Engineering Company.) Wu-sung District, Shang-hai. Has foundry. Produces diesel engines (up to 60 horsepower), gasoline engines (5 and 6 horsepower), oil pumps.

e. Construction Machinery.

Chung-hua Structural Engineering Company, Ltd. 90/ (30m) (Privately owned.) Has own power plant. Produces power shovels, cranes, steam rollers, cement mixers, pile drivers, stone and rock crushers.

f. Fabricated Structural Metal Products.

Hsin-heng-t'ai Iron Works.\* 91/ Produces iron framework for bridges and buildings and various types of iron construction equipment.

\* Not located on map.

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g. Mining Machinery.

Shang-hai Mining Machinery Factory. 92/ (31m) (Probably owned by the First Ministry of Machine Building Industry, formerly the Chien-hsing Machinery Plant, owned by the East China Department of Industry.) Produces mining machinery.

h. Independent Foundries Producing (Primarily) Cast and Forged Machine Parts.

Chiu-ho Iron Works. 93/ (32m, 33m) (Privately owned.) Total of 185 machine tools. Produces parts for various types of machinery, nails, lead wire.

Hua-feng Iron and Steel Company. 94/ (34m) (Probably owned by the First Ministry of Machine Building Industry.) Total of 31 machine tools. Produces various cast iron and cast steel machinery parts.

Hua-hsing Iron Works.\* 95/ (Probably owned by the First Ministry of Machine Building Industry.) Produces forged machinery parts (up to 1,100 lbs.).

2. Important Plants Producing Electrical and Electronic Apparatus, Appliances, and Supplies.

a. Motors, Generators and Transformers.

Ch'ien-yung-chi Electrical Equipment Mfg. Co., Ltd. 96/ (35e) (Privately owned.) Produces motors (up to 250 horsepower), motor-generator sets (up to 199 kilowatts), DC generators (up to 300 kilowatts), transformers (up to 500 kilovolt-ampere).

Hsin-an Electrical Equipment Plant. 97/ (36e) (Joint public-private owned; probably controlled by the First Ministry of Machine Building Industry.) Produces motors, generators, transformers, switch gear, and circuit breakers.

Hua-ch'eng Electric and Manufacturing Company, Ltd. 98/ (37e) (Privately owned, formerly the Hsin-hua Electric Machinery Mfg. Co.) Employed 15 technicians and 200 workers in 1941.

\* Not located.

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Employed 78 workers in 1950. Produces motors, generators and transformers, power distribution boards.

Hua-sheng (Wah-son) Electrical Equipment Plant. 99/ (38e, 39e)  
(Privately owned.) Produces generators (up to 300 kilowatts), transformers (up to 200 kilovolt-ampere), motors, (up to 400 kilowatts), circuit breakers, rheostats.

K'ai'ling Machinery Factory. 100/ (40e) (Privately owned.)  
Produces motors and generators.

Kung-yung (Popular) Electrical Equipment Mfg. Co. 101/ (41e)  
(Privately owned.) Has power generator. Produces motors, generators, transformers.

Shang-hai Electrical Machinery Works. 102/ (42e, 43e, 44e)  
(Probably owned by the First Ministry of Machine Building Industry.) Employed 2,000 workers in December, 1952. Produces motors (up to 600 horsepower), power transformers (up to 5,000 kilovolt-ampere), distribution transformers (up to 500 kilovolt-ampere), furnace transformers (up to 2,500 kilovolt-ampere).

b. Switch Gear, Switchboard Apparatus, and Industrial Controls.

Hua-t'ung Electrical Machinery Plant. 103/ (45e) (Joint state-private owned, probably controlled by the First Ministry of Machine Building Industry; also called Hua-t'ung Switch Factory.)  
Employed 204 workers in 1941. In late 1949 employed 20 administrators, 51 technicians and 250 workers. Produces circuit breakers, switchboards (up to 33,000 volts), switches, motor controls (for motors up to 500 horsepower), transformers (up to 500 kilovolt-ampere), meters, relays.

c. Electric Wire and Cable.

China Electric Engineering Trading Company.\* 104/ (Privately owned, formerly the Hua-sheng Iron Works.) Produces bare copper wire.

\* Not located on map.

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Shang-hai Wire and Cable Factory. 105/ (46e) (Probably owned by the First Ministry of Machine Building Industry, formerly the Wako Copper Smelting Plant - taken over by the NRC\* in 1946.) Facilities expanded in October, 1949 and again in April 1950. Employed approximately 2,000 workers in 1952. Produces magnet wire, annealed bare wire, and power cable. May be making communications cable in 1954.

Ya-ta Electric Wire Plant.\*\* 106/ Began production in 1953. Reported to be producing armored power and communications cable.

d. Lamps.

Chung-kuo Ya-p'u-erh (China Oppel) Electric Mfg. Co. Ltd. 107/ (47e, 48e, 49e) (Privately owned.) Produced vacuum and gas-filled lamps.

Hua-te (Wha Teh) Electric Manufacturing Company. 108/ (50e, 51e) (Privately owned.) Produces lamps.

Shang-hai Electric Lamp Plant. 109/ (52e) (Possibly owned by the First Ministry of Machine Building Industry, formerly the China General Edison Company.) Produces lamps.

Te-erh-k'o Electric Lamp Plant. 110/ (53e) (Privately owned.) Produces lamps, and tungsten and molybdenum wire.

T'ien-kuang (Tekon) Electrical Equipment Plant. 111/ (54e) (Privately owned.) Produces lamps.

Yung-chao (Evershine) Electric Lamp Plant. 112/ (55e) (Privately owned.) Produces lamps.

e. Wire Communications Equipment.

China Electric Company. 113/ (56e) Affiliated with the Shanghai Telephone Company; possibly controlled by the local govern-

\* National Resources Commission, a bureau of the Nationalist government which in 1949 operated many of the state-owned plants.

\*\* Not located on map.

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ment. Employed about 1,500 workers in November, 1952. Produces telephone sets, message registers, central switchboards, and components such as microfarad condensers.

Chung-yuan (Midland) Telephone Mfg. Co. Ltd. 114/ (57e)  
(Privately owned.) Produces telephone sets and switchboards.

East China Telecommunications Supply Bureau. 115/ (58e, 59e, 60e) Consists of 3 plants. K'un-ming Road plant makes telegraph paper tapes and carbon grains for telephone receivers. Chiang-ming Road plant assembles radio transmitters. The type of products manufactured by the third plant are not known.

f. Radio Communications Equipment.

Ya-chou (Asia) Radio Equipment Plant. 116/ (61e, 62e) Produces various radio equipment.

g. Batteries.

Chung-kuo (China) Storage Battery Works. 117/ (63e) (Privately owned.) Produces primary and storage batteries.

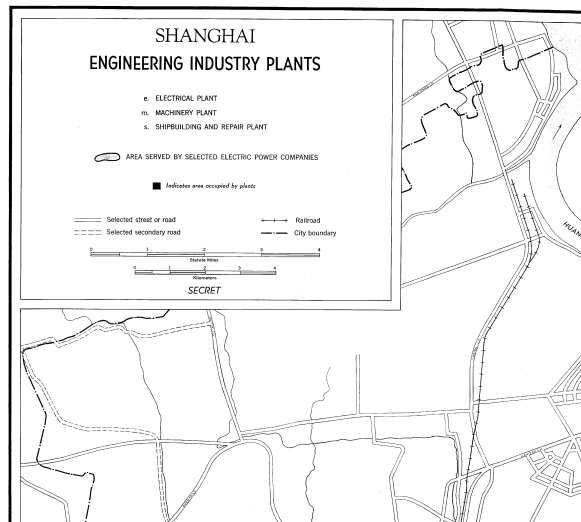
Shang-hai Battery Plant.\* 118/ (Possibly owned by the First Ministry of Machine Building Industry; probably the former battery-producing unit of the Central Electrical Works, NRC.) Produces storage (up to 4.5 volts), primary (up to 8 kilogram in weight), and special (up to 7 kilogram in weight) batteries.

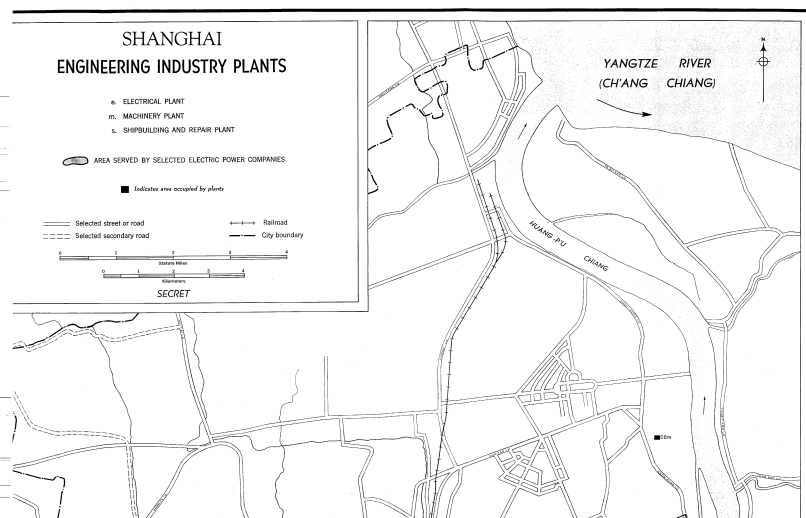
3. Important Plants Engaged in Shipbuilding and Repair.

Chiang-nan (Kiangnan) Shipyard. 119/ (64s) (Probably owned by the First Ministry of Machine Building Industry.) Builds and repairs naval craft; launched a 1,500 ton river passenger vessel in March, 1954. Foundry used to make heavy castings for machine tools, electrical machinery. Estimates of employment range from 2,000 to 8,000 workers. Yard suffered bomb damage in 1949-1950. Facilities (except building ways) subsequently restored and expanded. Has three operable graving docks: No. 1, 625 feet long; No. 2, 545 feet long; No. 3, 500 feet long.

\* Not located on map.

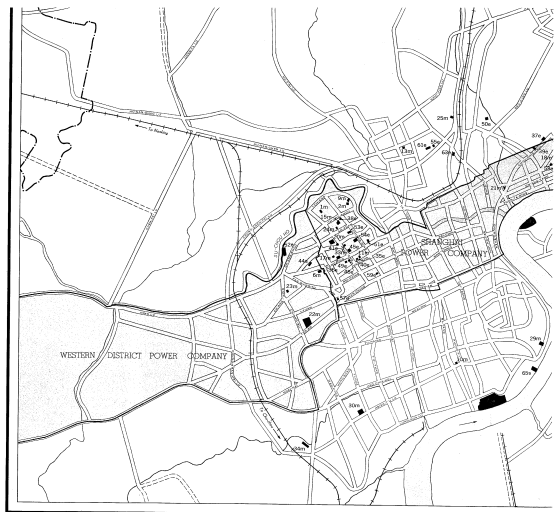
VEHICLE MANUFACTURE	
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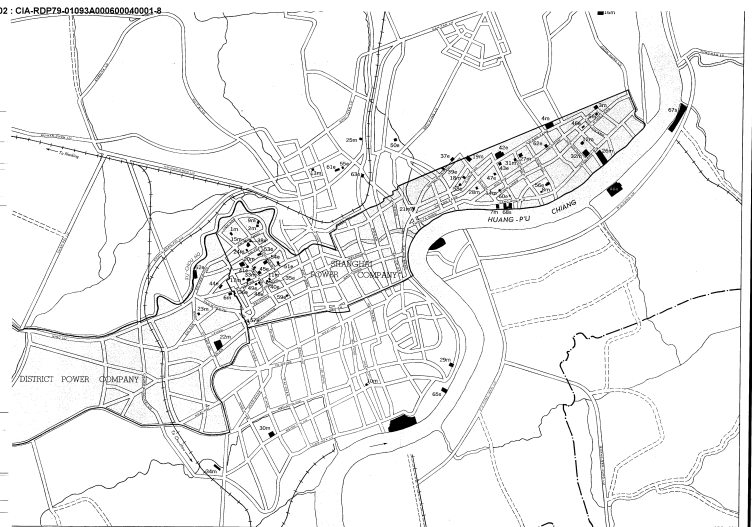




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Ch'iu-hsin (Kiou-sin) Shipbuilding and Engineering Works. 120/  
(65s) (Probably owned by the First Ministry of Machine Building Industry.) Repairs ocean-going merchant ships; produces diesel engines (up to 168 horsepower.) Has wooden graving dock with gate, 242 feet (top) by 35 feet (top). Employed 2,000 workers in 1952.

(Former) P'u-tung Branch, Chiang-nan Dockyard. 121/ (66s) (Area includes former Harvey's and Arnhold Brothers' yards, Liu-chia-tsui, P'u-tung.) Repairs ocean-going merchant vessels and small craft. Has graving dock 150 feet by 20 feet and 10 building ways up to 180 feet in length.

Hu-tung Shipyard. (67s) (Probably owned by the First Ministry of Machine Building Industry, formerly Mollers Shipbuilding and Engineering Works.) Builds small craft, including lighters, ferries, tugs, fishing trawlers, and barges up to 500 GRT. Has two building ways 200 feet in length. Estimates of employment range from 1,000 to 3,000 workers.

Shang-hai (Ying-lien) Dockyard, Ltd. 122/ (68s, 69s) (Probably owned by the First Ministry of Machine Building Industry.) Repairs ocean going merchant ships. Yang-shu-p'u Dock has two graving docks, 584 feet (top) and 346 feet (top) in length. Employed 3,000 workers in 1951. International Dry Dock has one graving dock, 540 feet in length. Employed 2,650 workers in early 1953.

4. Important Plants Which Have Not Been Identified or Located.\*

a. Machinery.

Shang-hai Boiler Plant. 123/ (Probably the P'u-kiang Machinery Plant.) Produces boilers and traveling cranes.

Shang-hai Industrial Equipment Plant. 124/ Produces machine tool parts.

\* The names listed in this section are probably new or alternative names of plants listed in the preceding sections. In some cases, an attempt has been made to guess the identity of the plant.

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Shang-hai Machinery Manufacturing Plant, No. 2. 125/ Produces machine tools.

Shang-hai Machine Tool Factory. 126/ (Probably Ch'iu-chiang Machinery Manufacturing Plant.) Produces machine tools.

Shang-hai Lathe Factory. 127/ Produces machine tools.

Shang-hai Shop Machinery Factory. 128/ (Possibly Ching-mei Machinery Plant.) Produces machine tools.

Shang-hai Steam Turbine Works. 129/ Produces turbines.

Central Machinery Factory, No. 1 (NRC). 130/ Produces engines.

Central Machinery Factory, No. 2 (NRC). 131/ Produces bicycles.

b. Electrical Equipment.

Shang-hai Electric Tool Factory. 132/ Produces "electric tools".

Central Electrical Supplies (NRC) Co. 133/ Produces porcelain insulators.

Central Radio Supplies Co. (NRC). 134/ Produces radio equipment.

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APPENDIX B

CHRONOLOGY OF MAJOR EVENTS AFFECTING THE ENGINEERING INDUSTRIES  
IN SHANG-HAI, 1842 TO 1954

- |                  |   |
|------------------|---|
| 1842             | Treaty of Nan-ch'ing. Shang-hai opened to the residence and commercial activity of foreign (British) traders.   |
| 1895             | Treaty of Shimonoseki. Foreigners permitted to engage openly in manufacturing in Shang-hai.   |
| 1937 (August)    | Japanese Attack on Shang-hai. A substantial proportion of the equipment in Chinese-owned engineering industry establishments evacuated to the area later known as "Free China." |
| 1945 (September) | Chinese (Nationalist) Government Re-occupied Shang-hai.   |
| 1949 (May)       | Chinese Communist Armies Occupied Shang-hai.  |

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APPENDIX C

METHODOLOGY

1. Production.

a. Index of Value-added.

The index of value-added (presented in Chart 1 following p. 6) was obtained by linking several indexes, each covering fragmentary time periods. For the period 1930 to 1950 the data used were as follows:

(1) 1930 through 1950 but excluding 1942 through 1944, an index of power consumption by bulk-power-consuming plants in the engineering industries located in the franchise areas of the Shang-hai and Western District Power Companies.\* 135/

(2) 1936 through 1944: an index of the production of machinery in Shang-hai. 136/

The electric power consumption index was used for the years not covered by the production index. It was checked for possible secular bias, which was not found to exist, by comparing it with an index of employment for the years 1931 and 1948.\*\* 137/ During the period covered by both the production and power consumption indexes it was found that in general they moved together, although the peaks and

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\* The boundaries of the two franchise districts coincided with the boundaries of the former International Settlement and the External (or Western) Roads areas. Except for the principal shipyards, most of the major engineering industry plants in Shang-hai are located within the two franchise districts.

\*\* The most probable secular bias in the power consumption index (that is, when used as an estimate of value-added) which might be expected to occur would be an upward bias resulting from a secular trend toward the substitution of power-using machinery (power utilized in these plants for lighting and similar uses is small in relation to total consumption) for labor. Such a trend would result in a rising ratio of power consumption to labor employment and to value-added.

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troughs in the power consumption index were substantially less pronounced than in the production index.\*

The index of value-added was extrapolated through 1953 on the basis of Communist claims of increased employment in the engineering and related industries in Shang-hai in 1952 and 1953. The claims were (a) that in 1953 "heavy industry" in Shang-hai employed 120,000 workers, and (b) that by 1952 employment in electrical equipment plants had doubled over the 1948 level.\*\* 138/ By estimating employment in 1953 in the shipyards (based on non-Communist estimates of the numbers of workers seen in most of the principal yards) and by assuming that employment in heavy industry other than engineering industry increased in proportion to the total (by 70 percent) during the period 1948 to 1953, an index of the increase in value-added in the engineering industry sector and in each of its principal components was estimated as given below: (1948 = 100)

Engineering industry:	192***
Machinery and independent foundries:	148
Electrical equipment:	230
Shipyards:	227

Because of the large and rapid increase in employment taking place during the period, substantially exceeding past peak levels of employment and not accompanied by a proportionate expansion of plant

\* A similar relation appears to apply in the United States. Between 1929 and 1950, indexes of (deflated) gross national product (GNP) and electric power production moved generally together although the peaks and troughs in the GNP index were much more pronounced than those in the power index. In both instances this may be accounted for by the lesser upward and downward flexibility of machine-time (as measured by power consumption) in comparison with the flexibility of employment and output.

\*\* Because of the lack of definite support for them from non-Communist sources, the claimed increases in employment appear high. They are utilized in this report, however, because they are unambiguous (in contrast to most Communist statements concerning the engineering industries in Shang-hai) and because non-Communist reports, while providing no more than mixed support to them, do not refute them. 139/

\*\*\* The index of employment expansion is 178. The index of value-added exceeds the index of employment because the expansion rates among the component industries differ. Value-added per worker is greatest in the shipbuilding and electrical equipment industries which experienced the sharpest employment gains.

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and equipment, it is possible that a considerable decline in value-added per worker took place, causing the index to overstate the increase in value-added. No account was taken of this possibility in constructing the index, however, because the extent of the probable decline is not measurable with presently available information.

b. Gross Product and Value-added.

A rough estimate of value-added in 1948 was made by calculating value-added per worker from available 1931 statistics 140/ and, after converting to 1952 prices, applying the ratio to 1948. Gross product in 1948 was estimated by applying the ratio of gross product to value-added prevailing in 1931 to the 1948 estimate of value-added. An independent estimate of gross product was attempted by multiplying the 1948 quantities produced of individual engineering products (listed in Tables 3 to 5) by their estimated 1952 prices 141/ and expanding the result by the ratio of parts production and repair to total production prevailing in 1931. Although on the basis of this check the general order of magnitude of the estimates appears reasonable, the results of the comparison were too inconclusive to provide a fully adequate check.

Value-added in 1953 was estimated by extrapolating the 1948 value-added estimates for the individual industries by means of the indexes given in the proceeding section. Gross product in 1953 was estimated by again applying the ratio of gross product to value-added prevailing in 1931.

The estimates of value-added and gross product obviously are subject to considerable margins of error. Apart from possible errors in the 1931 data or in the employment data, the principal source of error which might affect the estimates is a trend toward the substitution of other productive services (particularly plant and equipment) for labor (or vice versa).<sup>\*</sup> This source of possible error has been discussed in the preceding section in connection with the index of value-added.

<sup>\*</sup> The ratio of gross product to value-added may have been affected by changes in industrial organization and by changes in the ratio of the prices of raw materials to the prices of other productive services during the period. This possibility makes the estimates of gross product subject to a wider margin of error than the value-added estimates.

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c. Individual Commodities.

The 1948 production data for machinery and electrical equipment products were obtained from the relevant chapters of the Handbook of Chinese Manufactures. 142/ They were reported as "normal" or "average" monthly production figures. On the assumption that they were actually peak monthly production figures they were applied to the month of 1948 showing the highest level of output (as evidenced by monthly power consumption data) and were extrapolated throughout the year on the basis of a monthly index of electric power consumption.

The data on the construction of wooden ships was obtained from a CIA estimate 143/ of the total production in China. The proportion of the total produced in Shang-hai was estimated by applying a ratio of the number of workers employed in Shang-hai to total estimated employment in the industry.

Production of independent foundries for 1948 was taken from "The Machine Building Industry of Shang-hai" (Chi-chieh Chih-tsao, Shang-hai, 15 March 1950). 144/

Estimates of the production in 1953 of most of the items were made by applying the industry indexes presented in Section a (above) to the 1948 estimates. In the case of wooden ships, the expansion of production in 1953 was assumed to be half the rate for the industry to reflect the increase in the ratio of ship repair and the production of other engineering products to the construction of ships.

The estimate of the production of electric lamps was not increased for 1953 over 1948 because of a Communist press statement which indicated that lamp production capacity in 1950 was substantially below the reported 1948 production level. 145/

A rough check of the 1953 estimates was made by comparing them with available information on the capacities of individual plants reported to be producing the items in question to determine whether or not the order of magnitude of the estimates was feasible. Since there is no particular reason why the output of, say, a single machinery product should have expanded exactly in proportion to employment in the entire machinery industry, the 1953 estimates should be regarded only as rough indications of orders of magnitude.

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2. Input Requirements.

a. Manpower.

The amount of employment by industry (except for shipbuilding) in 1948 was obtained from a 1948 Nationalist Government survey published in the Economic Bulletin No. 104 (Hong Kong, January, 1949). 146/ Employment in shipyards and the breakdown of the labor force by level of skill were obtained from "The Machine Building Industry of Shang-hai" (Chi-chieh Chih-tsao, Shang-hai, 15 March 1950). 147/

The method employed in estimating 1953 manpower requirements has been discussed above. (See Section 1a, Appendix C.)

b. Materials.

Materials requirements for 1948 were obtained from "The Machine Building Industry of Shang-hai" (Chi-chieh Chih-tsao, Shang-hai, 15 March 1950). 148/ These data were checked roughly for reliability by estimating the 1948 iron, steel, and copper requirements of the principal metal-using commodities listed in Tables 3 to 5.

Estimated 1953 requirements were obtained by applying the "engineering industry" index of value-added on the 1948 base.

c. Plant and Equipment.

(1) Plant.

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(2) Equipment.

Data on the 1948 machine tool inventory were obtained from "The Machine Building Industry of Shang-hai" (Chi-chieh Chih-tsao, Shang-hai, 15 March 1950.) 149/ Requirements for 1953 were estimated by applying one half of the estimated rate of increase of the engineering industries (given in Section 1a above) to reflect the increased utilization of existing equipment. The 1953 estimated inventory of machine tools is subject to a considerable margin of error. The breakdown by type is subject to an even greater margin of error and is included only to indicate a typical breakdown of the total.

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3. Identification and Analysis of Important Plants.

a. Analysis.

At the outset, the available data on the engineering industries in Shang-hai consisted of fragmentary data on the production of a few engineering commodities, brief generalizations about the nature of the plants, and the names of a few individual plants, all of untested reliability.

This information was inadequate as a base for an intensive analysis of the nature and capacity of the industries for the period 1949 to 1954.

To acquire additional information and to establish a basis for evaluating the existing information, a detailed analysis of the principal individual plants comprising the industries was believed necessary.

The method employed was to collect from a wide variety of sources bits and pieces of specific plant information and to supplement this information with the results [REDACTED] studies of each of the plants. 25X1X4

It was found, however, that the collected pieces of plant information, even in combination with [REDACTED] results, were adequate for only the roughest of checks on the output estimates presented in Tables 3 to 5, and for basing the generalizations concerning the lack of rail transport facilities near the plants and the degree of vertical integration typical of the plants studied. 25X1X4

The preparation of independent estimates of output based on individual plant information will require considerably more information and more time devoted to [REDACTED] of individual plants. 25X1X4

b. Identification.

The collection of bits and pieces of plant information resulted in the accumulation of the names of and varying amounts of information on some 400 engineering industry plants in and about Shang-hai. Although considerably reduced by elimination of

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duplications\* this large number of plants had to be reduced further to keep the project within manageable proportions. Further reduction was accomplished by ignoring all plants except: The machinery plants listed as the "37 largest machinery plants in Shang-hai" in Ou-Yang-Lun, Economics of China in the Last Ten Years. 150/ The electrical equipment plants listed in Handbook of Chinese Manufactures. 151/ In addition, other well known plants not listed in the above sources were included as were large shipyards [REDACTED] 25X1X4

The 160-odd plants retained after this elimination were then located (by their street addresses where available) on the Map of Shang-hai Communications (Shang-hai People's Government, Land Office, November, 1951) which includes street numbers. 152/ From the map, plant locations were pinpointed on the photography.

Identification of the principal plants listed in Appendix A was made by eliminating most of the small plants (as determined from aerial photography) from the original list of 160 plants.

\* Duplications arise primarily from the frequent name changes of plants in Shang-hai during the last 17 years and from varying translations and transliterations of Chinese characters made from time to time.

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APPENDIX D

GAPS IN INTELLIGENCE

The general approach employed in this report was to analyze the nature and capacity of the engineering industries in Shang-hai as they existed at the beginning and during the early years of Communist domination to provide a firm basis for evaluating and projecting the changes taking place during the subsequent years of the Communist program.

The specific approach attempted in making this analysis was to project available aggregative information on the engineering industries covering the period up to 1949 on the basis of detailed plant information.

So little information was available on individual plants (even during the period prior to 1949), however, that this approach achieved only modest success. Little is known of the facilities existing in these plants, of the specific kinds of products produced, or of the quantities produced.

A critical gap is the lack of reliable non-Communist originated indications both of progress and development in the engineering industries as a whole and in individual engineering industry establishments. Except in the cases of information obtained [REDACTED] 25X1X4 [REDACTED] from the Shang-hai Power Company (up to September, 1950) and from non-Communist observers of developments in the shipyards, the major proportion of the post-1949 information upon which this report is based was obtained from Communist radio, newspaper, and periodical sources.

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APPENDIX E

SOURCES AND EVALUATION OF SOURCES

1. Evaluation of Sources.

The principal sources of aggregative information, The Growth and Industrialization of Shang-hai, The Handbook of Chinese Manufactures (for city-wide data on the production of individual commodities), the monthly reports of the Shang-hai Power Company, and various China Project reports, appear to be fairly reliable and have made possible an aggregative approach.

The principal sources of plant information utilized in this report, The Machine Building Industry of Shang-hai, The Economics of China in the Last Ten Years, The Handbook of Chinese Manufactures (for names, addresses, and capacities of important plants), the East China Industrial Bureau, Catalog of Sample Products, and various FDD reports of plant names and addresses obtained from newspapers and periodicals, [REDACTED] have made 25X1X4 possible reasonably accurate identification of the principal engineering industry plants.

FBIS reports have been a source of information on general developments since 1949. Because of their vagueness, however, they have (with a few exceptions) contributed little to an understanding of developments taking place.

The many interrogation reports of persons leaving Shang-hai have been contradictory and conflicting. They have supplied little basis for making quantitative estimates of developments in the engineering industries; yet because of their contradictory nature, they fail to lend support to estimates made on other bases.

2. Sources.

Evaluations, following the classification entry and designated "Eval.," have the following significance:

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<u>Source of Information</u>	<u>Information</u>
A - Completely reliable	Doc. - Documentary
B - Usually reliable	1 - Confirmed by other sources
C - Fairly reliable	2 - Probably true
D - Not usually reliable	3 - Possibly true
E - Not reliable	4 - Doubtful
F - Cannot be judged	5 - Probably false
	6 - Cannot be judged

Evaluations not otherwise designated are those appearing on the cited document; those designated "RR" are by the author of this report. No "RR" evaluation is given when the author agrees with the evaluation on the cited document.

"Documentary" refers to original documents of foreign governments and organizations; copies or translations of such documents by a staff officer; or information extracted from such documents by a staff officer, all of which will carry the field evaluation "Documentary" instead of a numerical grade.

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